DOCUMENT RESUME

ED 104 319 HE 006 466

AUTHOR Beatty, George, Jr.; And Others
TITLE A Simplified Approach to Interinstitutional Cost Comparison. Planning for Higher Education; Vol. 3, No. 6:5/6, December 1974.
INSTITUTION Society for Coll. and Univ. Planning, New York, N.Y.
PUB DATE Dec 74
NOTE 7p.

EDRS PRICE MF-$0.76 HC-$1.58 PLUS POSTAGE
DESCRIPTORS Colleges; Comparative Analysis; *Cost Effectiveness; *Cost Indexes; Costs; Educational Finance; Educational Planning; *Higher Education; *Institutional Research; *Statewide Planning; Universities

ABSTRACT

As more colleges and universities coordinate institutional research as a support system for long-range planning, new analytical tools are necessary. A system developed to project the effects of statewide policy alternatives may have wide applicability to other institutions and multi-institutional planning groups. The Instructional Cost Index procedure deals with only two levels of information. The first is the index that provides summary information, pointing out differences, for example, between indices of two institutions. The second level is the numerical values of the policy variables that explains the numerical differences of the indices. (MJM)

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planning for higher education

Vol. 3, No. 6: 5/6 December 1974

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A Simplified Approach to Interinstitutional Cost Comparison

As more colleges and universities coordinate institutional research as a support system for long-range planning, new analytical tools are necessary. A system developed in Massachusetts to project the effect of statewide policy alternatives may have wide applicability to other institutions and multi-institutional planning groups. The Instructional Cost Index was developed by George Beatty, Jr. and Warren W. Gulko, of the Office of Budgeting and Institutional Studies, University of Massachusetts, and by Bernard S. Sheehan, Office of Institutional Research, University of Calgary. An earlier version of this report was delivered at the SCUP-9 Conference in Denver in July, 1974.

In 1973, the presidents of the one hundred and eighteen public and private colleges and universities of the Commonwealth of Massachusetts formed a Public/Private Forum on Higher Education. The Forum's purpose is to further cooperation among the schools in responding to numerous statewide policy proposals. Early in its deliberations, the Forum found that intelligent decisions could not be made without quantifiable data to support assessments of current situations and forecasts of future trends. To deal with the need for additional data, a small working committee was established to advise the Public/Private Forum on basic higher education information appropriate for influencing policy decisions.

The initial committee project, referred to as the Cost Study, is directed toward developing uniform cost analysis procedures. Efforts have been made to utilize the analytical developments of other groups and agencies so that the recommendations adhere to accepted educational data reporting standards, yet remain appropriate to the unique mix of public and private institutions in Massachusetts.

Objectives of the Cost Study

In the context of limited time and resources, the following are primary objectives of the Cost Study:

- To identify the magnitude of direct instructional cost differences among the colleges and universities in the State.
- To provide information on factors which contribute to instructional cost differences.
- To provide a reasonable basis for comparative interpretation and analysis of instructional cost differentials.

Ancillary objectives of the Cost Study are:

- To serve as a first step in the evolution of a statewide higher education information system.
- To provide institutions with information useful for institutional management.
- To assist institutions in the development of the capability to provide analytical support for internal institutional management.
- To promote interinstitutional cooperation at all levels including formal and informal exchange of ideas.

Because of time and resource limitations, a number of questions germane to higher education cost comparisons could not be adequately investigated. These include faculty effort analysis, program structures and capital costs. It was decided to rely heavily on National Center for Higher Education Management Systems[1] definitions and procedures for faculty effort and program structures. However, no generally acceptable standards exist for capital cost expenditures.[2] Although such costs can significantly influence the outcome of analysis, there is no agreement at the present time as to whether they should be distributed to the cost of institutional programs. Capital expenditures at many institutions are critical to internal management decisions, and are an important component of the full cost of higher education. However, they usually do not directly influence the operating costs of the instructional program, except as an amortization expense component of total human cost. For this reason, we concluded that the purposes of this study are best served by excluding such costs.

Thus, the Cost Study is an effort of limited scope. Because of the unique mix of public and private

institutions in Massachusetts,[5] it is necessary to focus on a simplified procedure that minimizes data requirements and at the same time accommodates the diversity of programs present in the participating colleges and universities. Subsequent phases of the Cost Study will be a test of the methodology followed by a full-scale implementation of the data collection and reporting procedures.

The Instructional Cost Index

In undertaking the Cost Study, it was anticipated that the committee would be able to borrow heavily from the methodology proposed by the National Commission on the Financing of Postsecondary Education and NCHEMS. Reviews of these recommendations (17), (27) and of the work undertaken in other states (7), (26) show that the methodologies follow well defined cost accounting procedures, yielding cost figures as precise as the methodologies are complex. For our purposes, however, accuracy, both in the identification of cost differentials and in the identification of probable causes of the differences, is more important than precision. The focus on cost differentials seemed to require a departure from contemporary costing procedures[4] as represented, for example, by the recommendations of the National Commission on the Financing of Postsecondary Education. No claim of basic originality is made for our proposed procedure except possibly as a unique application of some fundamental notions.[5]

It is important to understand that we have not undertaken an instructional cost accounting study to determine the direct "cost of instruction." Our intent is rather one of simplified instructional cost analysis. Indeed, any cost study which purports to attribute a factual cost value to activities requires an explicit determination of three fundamental questions: 1) The cost of what? 2) The cost to whom? 3) The cost for which specific purposes? For the purpose of policy analysis, the cost to the institution[6] for direct instructional activities may be derived from a "process cost accounting" procedures (3), by imputing a cost indicator from data elements basic to the instructional program. Alternatively, the direct program costs of other institutional activities are derived by using a total cost approach, since our primary focus is instruction. In program areas such as research, academic support, student services, etc., we have adopted standard accounting procedures as recommended by College and University Business Administration (2), NCHEMS (27), and the Joint Accounting Group (15).

Determining cost values for policy purposes requires a methodology different from that required for other purposes, such as using cost values as a pricing tool for resource acquisition. Cost analysis for pricing purposes typically requires a "job costing" procedure (3) that utilizes cost centers, allocation conventions, and detailed accounting procedures. When costs are built up from individual cost centers, accounting procedures and conventions must handle all exceptions that might arise. Similarly, allocation conventions for attributing overhead costs to primary cost objectives may be useful for pricing purposes. However, overhead distributions do not contribute information for policy making on direct program activities.

Good policy analysis does not leave the policy maker at the mercy of the analyst. When the procedures used in cost analysis are so complex that variations in cost differentials are confused by conventions, allocations, and algebraic manipulations, the influence of policy variables is masked. For these reasons, among others, we have avoided the "full cost" notion of unit costing, where cost differentials are often due to allocation conventions, rather than to management decisions.

The Instructional Cost Index procedure deals with only two levels of information. The first is the Index itself, which provides summary information, pointing out differences, for example, between indices between two institutions.[7] The second level is the numerical values of the policy variables which explains the numerical differences of the indices. (A third level is the description of detailed operating policies explaining the differences between such values. This level is clearly beyond the scope of simple data collection. It is appropriately left to discussions between individual institutions.)

To make effective decisions, administrators must avoid bogging down in search of artificial precision. The policy analyst's basic rule has been stated as, "It is better to be roughly right than exactly wrong!" (8). We take this precept as our basis for proposing the Instructional Cost Index procedure as a simple yet effective method of identifying approximate indicators of instructional cost.

Policy Variables of Instructional Cost

We identify five policy variables as a minimum set for analyzing instructional costs. The numerical values of these variables characterize institutional policies that influence significantly the direct cost on instruction.

The first four variables determine the faculty salary component of the direct instructional cost. *Faculty compensation* reflects the institution's policy and priorities with respect to salary levels. Since institutions of higher education are labor intensive, expenditures following from faculty compensation policies are typically the major items of institutional operating budgets. *Class section size* reflects discipline or departmental policies. (It is a more meaningful variable

Planning for Higher Education Vol. 3, No. 6:5/6 December 1974 ©Society for College and University Planning, 3 Washington Square Village, Suite 1-A, New York, New York 10012. Publications Editor: Lawrence F. Kramer. Published in cooperation with Educational Facilities Laboratories, 477 Madison Avenue, New York, New York 10022.

than the student/faculty ratio, sometimes mistakenly used as a measure of class size policy.[8]) The size variable relates both to academic and fiscal policy.

Faculty teaching load, although a measure of the distribution of formal instructional activity, does not indicate the faculty resources committed to or expended on instructional activities. For this purpose we have defined *relative faculty effort* as a policy variable indicative of the amount of time or effort which faculty spend on instruction.

Instructional support expense includes the expense of graduate students, distributed departmental support personnel and expenses, and certain directly identifiable instructional expenses. For many programs, this variable describes the degree of non-faculty resource support.

As indicated earlier, the purpose of the policy variables is to provide numerical information to help decision makers focus on probable causes of differences in instructional cost indices. Thus, beyond being indicative of instructional policies, the numerical values have only that significance revealed by further investigation and discussion.

The Range of Values

A comparison of the numerical values of the policy variables will indicate quantitative causes for variations in indices. Investigating differences in the numerical values of policy variables is a significant *first step* in using the Instructional Cost Index information for improving institutional management and for developing statewide policies.

The range of possible numerical values for each policy variable depends on the level of data aggregation and analysis. For this discussion, we assume that the policy variables relate to the Instructional Cost Index as an average of the values at the aggregate discipline category level by institution. Hypothetical ranges appear in **Table 1.**

Table 1 — Range of the Fundamental Policy Variables

Policy Variable	Range of Typical Average Values*	Relative Variation
Faculty salary	$11,000 - $22,000	1:2
Faculty load	6 hr. - 15 hr.	1:2½
Relative faculty effort	0.40 - 0.98	1:2½
Class size	6 - 60	1:10
Instructional support expense	$2 - $100	1:50
Instructional Cost Index	7 - 700	1:100

The average faculty compensation ranges from about $11,000 to $22,000,[9] for a maximum relative change on the order of 1:2. The variation of the average relative faculty effort and average faculty load may each be reasonably estimated to be approximately 1:2½. Average class size typically takes on a much larger range of values. Given the variety of instructional delivery systems and alternative resource mixes among academic disciplines, the instructional support expense variable may also take on a wide range of values. Obviously, it will be necessary to examine data from various institutions before these ranges can be verified.

The Instructional Cost Index varies directly with average faculty salary and relative faculty effort, and inversely with average faculty load and average class size for fixed values of support expense. The practical academic relationships among the policy variables suggest that extreme values of the Index are unlikely *within* an institution. However, *across a large number* of public and private institutions—as in Massachusetts—wide variations are expected. Given the possible values for policy variables enumerated above, it seems clear that the policy variables most likely to cause large variations in the Index are average class size and instructional support expense.

Distributing the Relative Faculty Effort

College and university faculty frequently engage in assigned activities beyond the instructional program. The Instructional Cost Index includes a policy variable which reflects the proportion of faculty effort[10] devoted to instructional activities. Under most circumstances, this factor will range from an average of 40% to 98% of the faculty effort in a given department. It may vary from 0% to 100% for individual faculty persons. The proportion of faculty effort devoted to instruction may, for some institutions, be the most difficult data element to provide.

For the purpose of aggregate analysis, particularly among homogeneous units, it may be sufficient to use a single variable that estimates the proportion of faculty effort across all levels of instruction. For comparison of similar institutions it may be sufficient to assume that the relative faculty effort is equivalent in all cases and, therefore, to ignore this particular variable. Whether relative faculty effort is included in the Index depends primarily on the purpose of the analysis, but also on the information value of the data, the degree of precision sought, and the extent of homogeneity among the units to be compared.

Data Requirements

The basic Instructional Cost Index procedure requires only seven data elements:

- The total measure of instructional offerings[11]
- The total measure of student instructional activity.[12]
- The average relative faculty effort.
- The full-time equivalent number of faculty.
- The total faculty compensation expense.
- The expense for directly identified instructional support (teaching assistants, lab supplies, etc.).
- The total academic department expenses for support personnel, supplies, etc., *not* directly attributed to the instructional program.

Since the Index is intended for wide use, the data upon which it rests must be widely available. For this reason,

elements selected represent the minimum set of those data elements currently used (or in our opinion, those that should be used) by academic administrators for policy planning and analysis. Special efforts were made to insure data element compatibility with standards being developed at NCHEMS (9) and with definitions proposed as national standards by the National Commission on the Financing of Postsecondary Education (17). These standards apply primarily to the costs of instruction. Financial data relating to other areas of institutional operations are defined according to JAG (15) and CUBA (2) categories.

The Instructional Cost Index may alternatively be expressed in terms of fundamental policy variables which are derived from the basic data elements. Because of this flexibility, the Instructional Cost Index has a number of distinct advantages for policy-making purposes, in addition to those already mentioned. The relationship between values of the Index and corresponding values of policy variables is straightforward and easily understood. Moreover, the policy maker is not dependent upon the outcome of analysis for information, but can proceed directly from cost differences to policy variables values in order to determine which factors caused the differences.

Application of the Instructional Cost Index

To demonstrate the application of the Instructional Cost Index, data were collected from five sample academic departments at the University of Massachusetts at Amherst. **Table 2** displays this data as representative of discipline clusters, including college total. Although only seven basic data elements are required, three of these elements are displayed by level of instruction, in the belief that more useful policy information emerges if the Instructional Cost Index is developed from data for distinct levels of instruction. These distinctions are desirable because large cost differentials may exist between levels of instruction. In addition, separating levels of instruction will assist comparisons among different types of institutions.

Student credit hours and course credit hours by level of instruction were available from institutional files. Relative faculty effort data, more difficult to obtain, required an estimating procedure. The estimates were developed from a previously administered campus faculty activity analysis.

Identifying Significant Policy Variables

Information in **Table 3** was obtained through computations from the basic data presented in **Table 1**. Relative faculty effort data in **Table 3** is a summation of relative faculty effort by level of instruction. An Instructional Cost Index for each discipline cluster was calculated using these five policy variables.

Examination of the data in **Table 3** will point to the policy variables that cause differences in the Instructional Cost Indices. For example, the Instructional Cost Index for Engineering is approximately 2.5 times greater than that for Humanities. The average class size in Engineering is approximately one half that of Humanities, and can be identified as a major cause of the Index differential. Although slight differences are discernable in faculty load, relative faculty effort, and faculty compensation, the two largest contributors to the differential are class size and support expense. A comparison between Business and Social Sciences, two discipline clusters that have almost equal Instructional Cost Indices, indicates that the values of each set of policy variables are relatively close.

Much attention has recently been directed toward comparing annual student costs.[13] Such comparisons indicate differentials due to curricular and instructional differences. It may be argued that curricular differences in many cases contribute to the differential only because of instructional cost differences among departments. Therefore, it seems to us that annual per-student cost data may not contribute significantly to improved college planning and management. Nevertheless, in some instances, it may be necessary to compare the annual direct instructional cost per student across fields of study, student levels, and/or institutions. For these purposes, the Instructional Cost Index may be used as an approximate cost, which, when weighted by the average distribution of a student curriculum, yields an estimate of annual direct instructional cost per student.

An example of this application is displayed in **Table 4**, where the computed Instructional Cost Index for several discipline clusters is shown with the distribution of mean annual student credit hour loads for several fields of student.[14] The average annual student cost by major field of student is obtained by multiplying the Instructional Cost Index for each discipline cluster by the average annual student load within that cluster and summing the products for each average student curriculum. This type of information may be used to array the average annual student cost in various disciplines for internal institutional comparisons.

Using the Cost Index

Information provided by the Instructional Cost Index and related policy variables is useful for policy analysis requiring comparative data on instructional costs. This information is easily understood by both administrators and analysts. It provides useful insight into the effects of institutional policies, thereby assisting decision making. Moreover, the Instructional Cost Index is a powerful method of identifying cost differences from a simple and relatively accessible data set. In considering future academic and resource allocation policies, the Instructional Cost Index is an appropriate and simple methodology for cost comparison.

—George Beatty, Jr.
Warren W. Gulko
Bernard S. Sheehan

Table 2 – Basic Input Data Required for the Instructional Cost Index

Data Element	Level of Instruction	Business	Biological Sciences	Humanities	Engineering	Social Sciences	College Totals
Student credit hours	Lower	5,781	10,693	5,938	1,310	6,285	30,007
	Upper	2,817	5,601	11,051	1,272	11,501	32,242
	Graduate	1,905	1,749	13,156	1,105	1,368	19,283
Course credit hours	Lower	195	141	269	61	125	791
	Upper	96	167	531	130	257	1,181
	Graduate	94	404	899	163	267	1,827
Relative faculty effort	Lower	17%	14%	19%	11%	10%	14%
	Upper	22%	20%	20%	22%	20%	21%
	Graduate	29%	31%	30%	28%	28%	29%
Full-time equivalent faculty	All levels	17.7	44.2	104.7	26.2	36.5	229.3
Faculty compensation	All levels	$366,315	$905,195	$1,917,339	$565,856	$731,048	$4,485,753
Support personnel & Supplies	All levels	$19,596	$267,648	$102,881	$71,011	$60,819	$521,955
Other direct instructional costs	All levels	$24,154	$131,550	$28,105	$47,839	$83,611	$315,259

Table 3 – Policy Variables Derived from Basic Input Data

Policy Variables	Discipline Cluster					
	Business	Biological Sciences	Humanities	Engineering	Social Sciences	College Totals
Average class size *(Enrollees)*	27.3	25.3	17.9	10.4	29.5	21.5
Average faculty load *(Semester CCH/FTE faculty)*	10.9	8.1	8.0	6.8	8.9	8.3
Relative faculty effort *(Percent)*	68%	65%	69%	61%	58%	64$
Average faculty compensation *($/FTE faculty)*	$20,696	$20,480	$18,313	$21,598	$20,029	$19,563
Average support expense *($/SCH)*	$3.43	$16.92	$3.29	$24.72	$6.21	$7.96
Instructional Cost Index	27.1	49.5	47.2	118.3	28.3	43.2

Table 4 – Example of Computing Average Annual Direct Instructional Cost Per Student

Discipline Cluster	Instructional Cost Index	Student Major Fields of Study									
		Business		Biological Sciences		Humanities		Engineering		Social Sciences	
		Av. Sch.	Av. Cost	Av. Sch.	Av. Cost	Av. Sch.	Av. Cost	Av. Sch.	Av. Cost	Av. Sch.	Av. Cost
Business	27.1	10	$ 271	2	$ 54	–	$ –	–	$ –	–	$ –
Biological Sciences	49.5	8	396	10	495	8	396	8	396	6	297
Humanities	47.2	6	283	8	378	12	566	6	283	12	566
Engineering	118.3	–	–	–	–	–	–	12	1,420	–	–
Social Sciences	28.3	6	170	12	340	11	311	4	113	12	340
Totals Per Year		30	$1,120	32	$1,267	31	$1,273	30	$2,212	30	$1,203

Note: Average cost numbers are rounded to the nearest dollar.

NOTES

[1]NCHEMS has provided many accepted standards appropriate to data analysis including (12), (9), and (15).

[2]The issue of accounting for capital cost is not unique to higher education, e.g., (30). NCHEMS has proposed standards (27) which are now being reviewed nationally.

[3]Approximately 58% of the students in Massachusetts are enrolled in private colleges and universities (21).

[4]Contemporary costing methodologies have not changed significantly for at least fifty years. See, for example (25).

[5]The basic relationships have been described by many authors including (19), (23), (29) and (32).

[6]We use Anthony's definition of cost as a measure of the use of resources (4).

[7]These procedures apply equally to comparisons within an institution, by department or discipline, by level of instruction, between alternative types of institutions, or various combinations of level, discipline, and institution.

[8]See, for example, (11).

[9]This estimate is based on the Fall 1973 AAUP survey (1).

[10]We equate "effort" to the proportion of faculty assignment attributable to a program activity. See (22).

[11]Instructional offerings (i.e., courses) are measured in terms of credits, contact hours, sections, or some other means of weighting each instructional activity.

[12]Student instructional activity is determined from the number of students engaging in a particular instructional activity (those enrolled) and the weight attached to that activity (course credit hours, weekly contact hours).

[13]See, for example, (16).

[14]In order to construct Table 4 it is necessary to compute the mean number of units taken in each department by a student in a given major field of study. The array of these values is known as an Induced Course Matrix (ICLM). Further information may be found in (6).

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